ZooKeys 95: 95–117 (2016)
doi: 10.3897/zookeys.95.9179
http://zookeys.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

Definition of the *jianfengling* species group of the ground beetle genus *Orthogonius* MacLeay (Coleoptera, Carabidae, Orthogoniini)

Mingyi Tian[1], Thierry Deuve[2]

1 *Department of Entomology, College of Agriculture, South China Agricultural University, Wushan, Guangzhou, 510640, China* **2** *Muséum national d'Histoire naturelle, Département de Systématique & Évolution, Entomologie, C. P. 50, 57 rue Cuvier, F–5231 Paris cedex 05, France*

Corresponding author: *Mingyi Tian* (mytian@scau.edu.cn)

Academic editor: *B. Guéorguiev* | Received 12 May 2016 | Accepted 20 July 2016 | Published 7 September 2016

http://zoobank.org/CD8DC9AF-6758-4F44-A1CF-3FF1C09043AD

Citation: Tian M, Deuve T (2016) Definition of the *jianfengling* species group of the ground beetle genus *Orthogonius* MacLeay (Coleoptera, Carabidae, Orthogoniini). ZooKeys 615: 95–117. doi: 10.3897/zookeys.615.9179

Abstract

The *jianfengling* species group of the termitophilous carabid genus *Orthogonius* MacLeay, 1825 is defined and reviewed. This species group ranges from southern China, crossing Indochina and Myanmar to eastern India. To date, the *jianfengling* species group is composed of ten species, including six new species which are hereinafter described and illustrated: *O. wrasei* **sp. n.** (Myanmar), *O. bellus* **sp. n.** and *O. limbourgi* **sp. n.** (Vietnam), *O. politior* **sp. n.**, *O. aberlenci* **sp. n.** (Laos) and *O. meghalayaensis* **sp. n.** (India). Habitus, elytral apices and male genitalia of all species are illustrated. A key to species and a distribution map of *jianfengling* species group are provided.

Keywords

Carabids, Indo-Burma, new species, taxonomy, termitophilous

Introduction

Indo-Burma is one of the 25 biodiversity hotspots in the world for conservation priorities (Myers et al. 2000). It covers a large tropical area of more than two million square kilometers, from eastern India, through Myanmar to southern China to the east, and

Copyright *Mingyi Tian, Thierry Deuve*. This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

to northern of Malaya Peninsula to the south. The termitophilous ground beetles of the tribe Orthogoniini are very rich in species diversity in this area, represented by approximately 100 species (Tian and Deuve 2000, 2006, 2010, Tian et al. 2012).

The majority of orthogoniine species recorded in tropical Asia belongs to the prominent genus *Orthogonius* MacLeay, 1825. As the series works to understand the faunal composition and to set up a rational classification system of *Orthogonius*, the *lancangjiang* and *baconii* species groups have already been dealt with (Tian and Deuve 2013, 2016). In the present paper we define the *jianfengling* species group.

The *jianfengling* species group is comprised of members of large, polish, depressed and glabrous orthogoniine beetles. The first species of this group, *O. jianfengling* Tian & Deuve, was described in 2000 from Hainan Island, China. Then, *O. himalayicus* Tian & Deuve, 2005 (from Bhutan and Sikkim, India), *O. freyi* Tian & Deuve, 2006 (from Myanmar) and *O. duboisi* Tian & Deuve, 2006 (from Yunnan, China) were recorded respectively (Tian and Deuve 2005, 2006). To date, ten *Orthogonius* species are designed as members of the *jianfengling* species group, including six new species described below.

Material and methods

All specimens for this study are dry and mounted materials. Dissection and observation of the specimens were made using a WILD M32 binocular microscope. Detailed descriptions are provided for the new species, while only diagnostic character states are given for the known species. Digital photographs were taken and processed in the same as in Tian and Deuve (2013).

Body length was measured from apex of right mandibles to apex of elytra; body width = width of elytra.

Abbreviations of measurements used in the text are as followings:

HL head length (from apex of right mandible to base of vertex);
HW head width (maximum distance across head, including eyes);
PL length of pronotum (measured from front to basal margins, through midline);
PW width of pronotum (greatest width of pronotum);
EL length of elytra (measured from base to apex of elytra, through suture);
EW width of elytra (greatest transverse distance across both elytra).

Abbreviations of collections mentioned in the text are as following

CDW Collection of David Wrase, Berlin
CIB Collection of Ingo Brunk, Dresden
CIRAD Agricultural Research for Development, Montpellier
HNML Natural History Museum, London
IRSNB Institut royal des Sciences naturelle de Belgique, Brussels
MNHN Muséum national d'Histoire naturelle, Paris

NHMB Naturalhistorisches Museum, Basal
NHMV Natural History Museum of Vienna, Vienna
SCAU South China Agricultural University, Guangzhou

Taxonomic treatment

Genus *Orthogonius* MacLeay, 1825

jianfengling species group

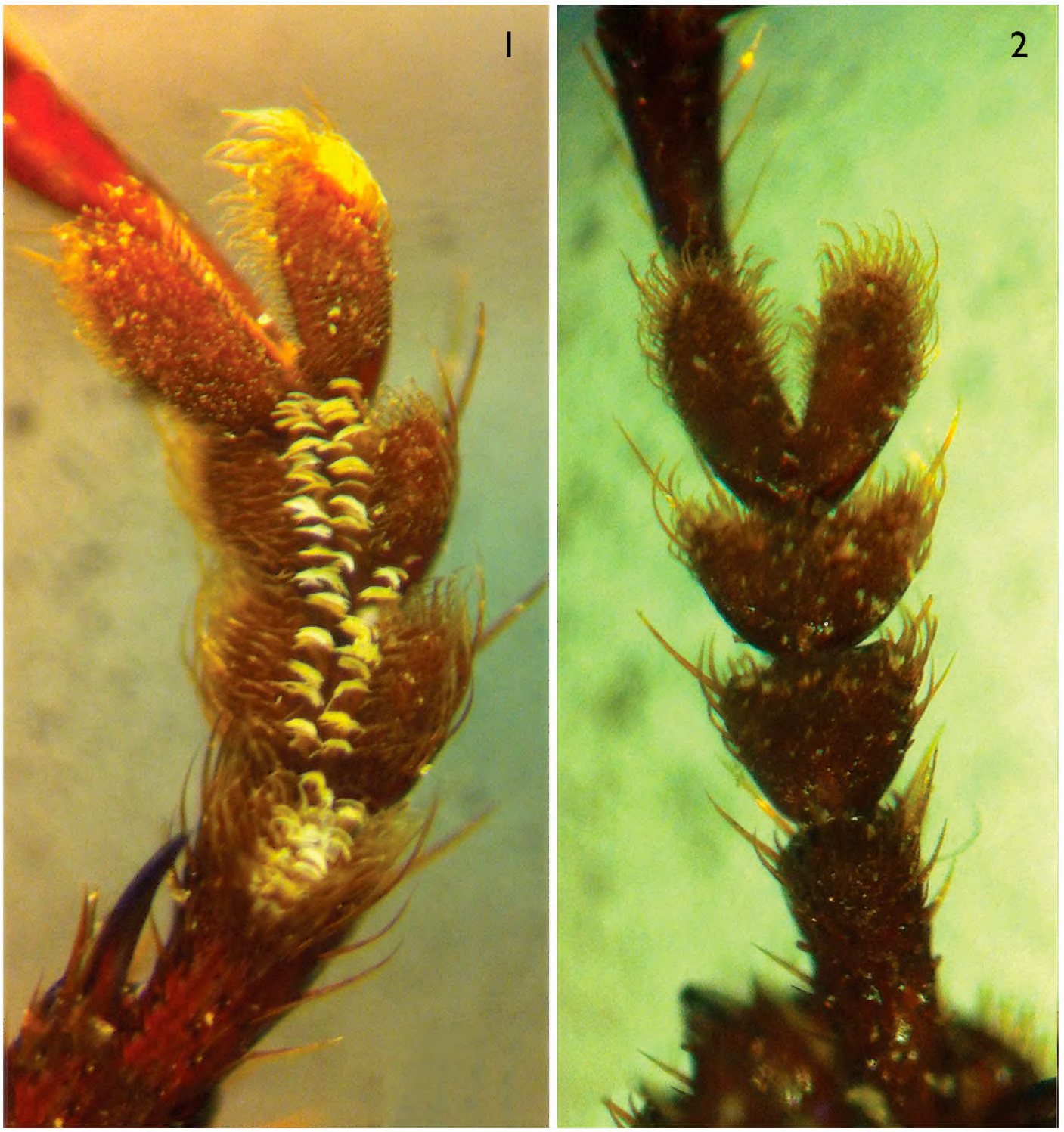
Definition. The *jianfengling* species group shares the following combination of morphological characteristics: (1) Medium to large sized; body elongate and more or less flat; polish and very smooth, strongly shiny, impunctate; (2) Labrum more or less concave or emarginate at frontal margin; ligula bisetose at apex; each of mentum and submentum bisetose; mentum edentate in most species (but toothed medially in *O. meghalayaensis* sp. n.); (3) Hind angle of pronotum rounded off; (4) Elytra well-bordered at base, nearly parallel-sided medially; striae shallow or deep, intervals convex, the 3rd interval with three setiferous pores (but median one wanted in *O. freyi*), the 7th interval not carinated; apex of elytra obliquely truncate, bisinuate or sinuate, outer apical angle rounded off, the inner apical angle various shaped, obtuse or rectangular, denticulate at tip or not; (5) Middle coxae setose medially in most species (but asetose in *O. bellus* sp. n., and *O. limbourgi* sp. n.); middle and hind tibiae slender, not dilated in male; femora moderately long; hind tibial spurs moderate in length, very sharp; the 4th hind tarsomere bilobed; hind femora bisetose to quadrisetose posteriorly; tarsal claws especially the hind ones weakly pectinate; (6) Abdominal ventrite VII in male not emarginate at apical margin; and (7) Male genitalia not exposed; aedeagus short and stout, widely opened dorsally, apical lamella short; parameres normal for *Orthogonius*.

Sexual dimorphism. In male, 1st (apical half) to 3rd protarsomeres bearing two rows of spongy setae which are flat and located along median portion (Figs 1–2); ventrite VII not emarginated in both sexes.

Distribution of the *jianfengling* species group. The *jianfengling* species group are distributed in the following countries: China (*O. jianfengling* and *O. duboisi*), Vietnam (*O. bellus* sp. n. and *limbourgi* sp. n.), Laos (*O. politior* sp. n. and *O. aberlenci* sp. n.), Myanmar (*O. freyi* and *O. wrasei* sp. n., India (*O. meghalayaensis* sp. n., and *O. himalayicus*) and Bhutan (*O. himalayicus*) (Fig. 3).

Key to species of *jianfengling* species group

1 Body large sized and depressed, polish, smooth and glabrous, ventrite VII in male not emarginate at apical margin, aedeagus not exposed..... ..... ***jianfengling* species group...2**



Figures 1–2. Protarsi of *O. limbourgi* sp. n. **1** male **2** female.

–	Combination of other differences	**other species groups of *Orthogonius***
2	Prosternal process unbordered at apex.....	**3**
–	Prosternal process bordered at apex	**5**
3	Mentum with a median tooth, abdominal ventrite VII bearing three pairs of setae.....	***O. meghalayaensis* sp. n.**
–	Mentum edentate, abdominal ventrite VII bearing two pairs of setae.....	**4**
4	Head slender, labrum deeply emarginate at front, eyes less convex.....	***O. himalayicus***
–	Head stouter, labrum shallowly emarginate at front, eyes more convex.....	***O. politior* sp. n.**
5	Pronotum and elytra entirely reddish brown; scutellum widely obtuse; lateral expanded margins of pronotum distinctly reflexed	***O. jianfengling***

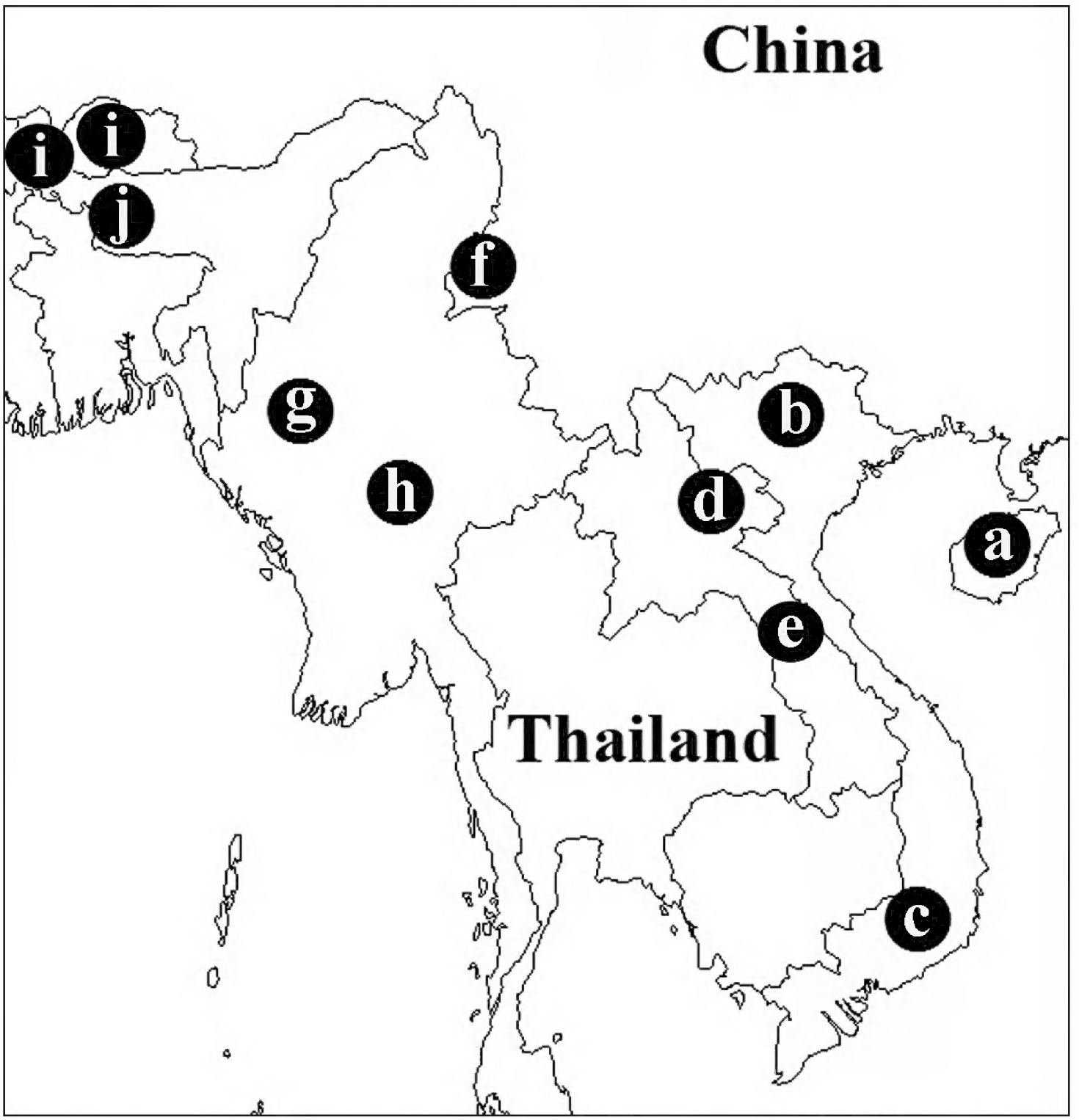


Figure 3. Distribution of the *jianfengling* species group **a** *O. jianfengling* **b** *O. limbourgi* sp. n. **c** *O. bellus* sp. n. **d** *O. politior* sp. n. **e** *O. aberlenci* sp. n. **f** *O. duboisi* **g** *O. wrasei* sp. n. **h** *O. freyi* **i** *O. himalayicus* **j** *O. meghalayaensis* sp. n.

– At least disc of pronotum light dark brown; scutellum narrowly obtuse; lateral expanded margins of pronotum either flat or slightly reflexed **6**

6 Elytral interval 3 with only two setiferous pores, middle one wanted... ***O. freyi***

– Elytral interval 3 with three setiferous pores..... 7

7 Body brown or yellowish brown **8**

– Body black or dark brown **10**

8 Middle coxae setose medially, apical inner angle of elytra obtuse, not denticulate at tip ..... ***O. aberlenci* sp. n.**

– Middle coxae asetose medially, apical inner angle of elytra nearly rectangular, distinctly denticulate at tip..... **9**

9	Body more depressed, hind 3rd tarsomere longer than 4th .... ***O. limbourgi* sp. n.**
–	Body less depressed, hind 3rd tarsomere as long as 4th ..... ***O. bellus* sp. n.**
10	Apex of elytron deeply sinuate, inner angle obtuse ..... ***O. duboisi***
–	Apex of elytron shallowly sinuate, inner angle nearly rectangular .... ***O. wrasei* sp. n.**

Orthogonius jianfengling Tian & Deuve, 2000

Figs 3a, 4, 14

Orthogonius jianfengling Tian & Deuve, 2000: 298.

Length. 15.0–17.0 mm; width: 5.5–6.0 mm. Habitus as in Fig. 4.

Description. Body elongate, strongly shiny, smooth and glabrous; head dark brown, pronotum, elytra and legs red brown, impunctate, microsculptural engraved meshes isodiametric. Head slightly longer than wide, HL/HW = 1.11; clypeus bisetose, labrum sex-setose, shallowly emarginate at apical margin; mentum edentate; each of mentum and submentum bisetose. Pronotum strongly transverse, PW/PL = 1.55, disc moderately convex, apical and basal margins well beaded, sides evenly expanded, widest at middle; base slightly wider than apex, lateral expanded margin well-defined, evenly and distinctly reflexed. Elytra elongate, and rather flat, EL/EW = 1.84, widest at about middle, parallel-sided at middle, basal border complete, apex bisinuate, inner angle blunt, not denticulate at tip (Fig. 14), the 3rd interval with three setiferous pores. Legs slender, fore tibiae expanded at apex, with outer angle strongly protrude, outer margin smooth, sub-serrate; middle coxae setose medially, hind coxae smooth and glabrous, the 3rd and 4th hind tarsomeres subequal in length, the 4th bilobed at apex; all tarsal claws weakly pectinate. Prosternal process bordered at apex.

Male: Unknown.

Remarks. It is probably close to *O. limbourgi* sp. n., distinguished from the latter by its distinctly reflexed lateral expanded margins of pronotum (slightly reflexed in *O. limbourgi*), and setose middle coxae (asetose in *O. limbourgi*).

Material examined. 1 female, the holotype, "Hainan: Ledong Xian: Jianfengling, 15. VI. 1983, Gu Maobin leg.", in SCAU; 1 female, a paratype, ibid. in MNHN.

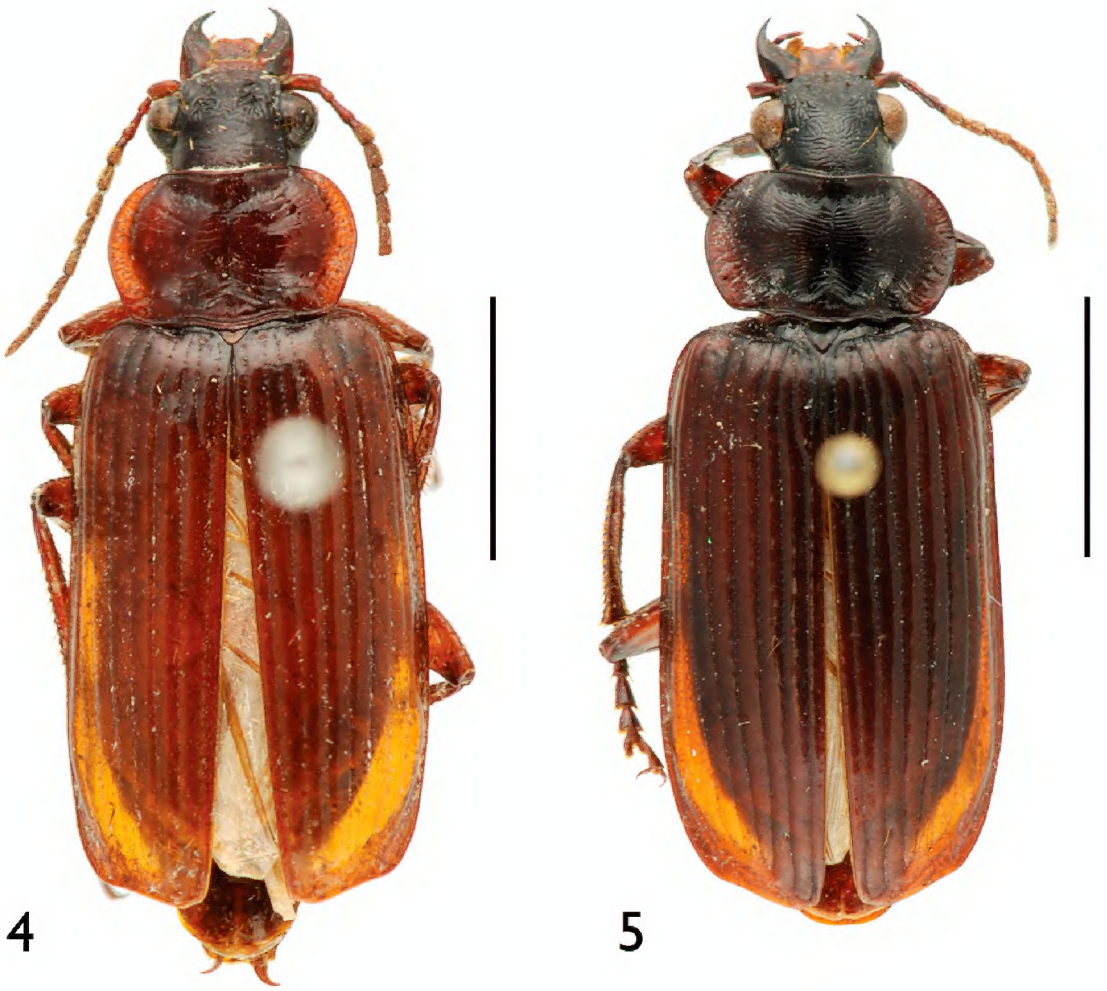
Distribution. China (Hainan Island) (Fig. 3a).

Orthogonius himalayicus Tian & Deuve, 2005

Figs 3i, 5, 15, 24–25

Orthogonius himalayicus Tian & Deuve, 2005: 61.

Length. 19.0–20.0 mm; width: 6.5–7.0 mm (measurements in the original description were not correct). Habitus as in Fig. 5.



Figures 4–7. Habitus **4** *O. jianfengling* **5** *O. himalayicus* **6** *O. limbourgi* sp. n. **7** *O. politior* sp. n. Scale bar: 5.0 mm.

Description. Head and pronotum black, antennae and elytra dark brown, slender and very shinny; body smooth and glabrous, head and pronotum impunctate, elytral odd intervals with a few, sparse punctures which are irregularly arranged; head intricately wrinkled; microsculptural engraved meshes densely isodiametric, faint on head and pronotum, clear on elytra. Head slightly longer than wide, HL/HW = 1.15–1.18; labrum deeply emarginate at front; eyes comparatively small, but prominent; mentum edentate and bisetose, submentum bisetose. Pronotum transverse, PW/PL = 1.91–1.94, rather flat, lateral expanded margin wide and slightly reflexed, widest at middle. Elytra elongate and rather slender, EL/EW = 1.74–1.77, parallel-sided at middle, moderately convex, widest slightly behind middle, apex obliquely truncate, inner angles roundly obtuse (Fig. 15); striae very deep, intervals distinctly convex, the 3rd intervals generally with three setiferous pores. Legs moderately long, middle coxae setose, the 3rd and 4th hind tarsomeres subequal in length, all tarsal claws weakly pectinate. Prosternal process unbordered at apex. Male genitalia (Figs 24–25) with the median lobe of aedeagus comparatively small and short, middle portion convex, apex pointed in lateral view, turning to right, obtuse dorsally.

Remarks. Differs from other congeners by its deeply concaved labrum and broadly obtuse inner apex of elytron.

Material examined. 1 male, the holotype: "British Bootang, L. Durel, 1898", in MNHN; 2 males, paratypes, "Pedong, A. Desgodins"; 1 male and 2 females, paratypes, "British Bootang, Maria Basti. L. Durel"; 1 male, a paratype: "Sikkim" only; 1 female, a paratype: "Museum Paris, Bhutan. R. Oberthür, 1900", all in MNHN, except one male in SCAU.

Distribution. Bhutan and Sikkim (Fig. 3i).

Orthogonius limbourgi sp. n.

http://zoobank.org/107BEE2C-7B57-4A69-9CF4-E7B8FC708376

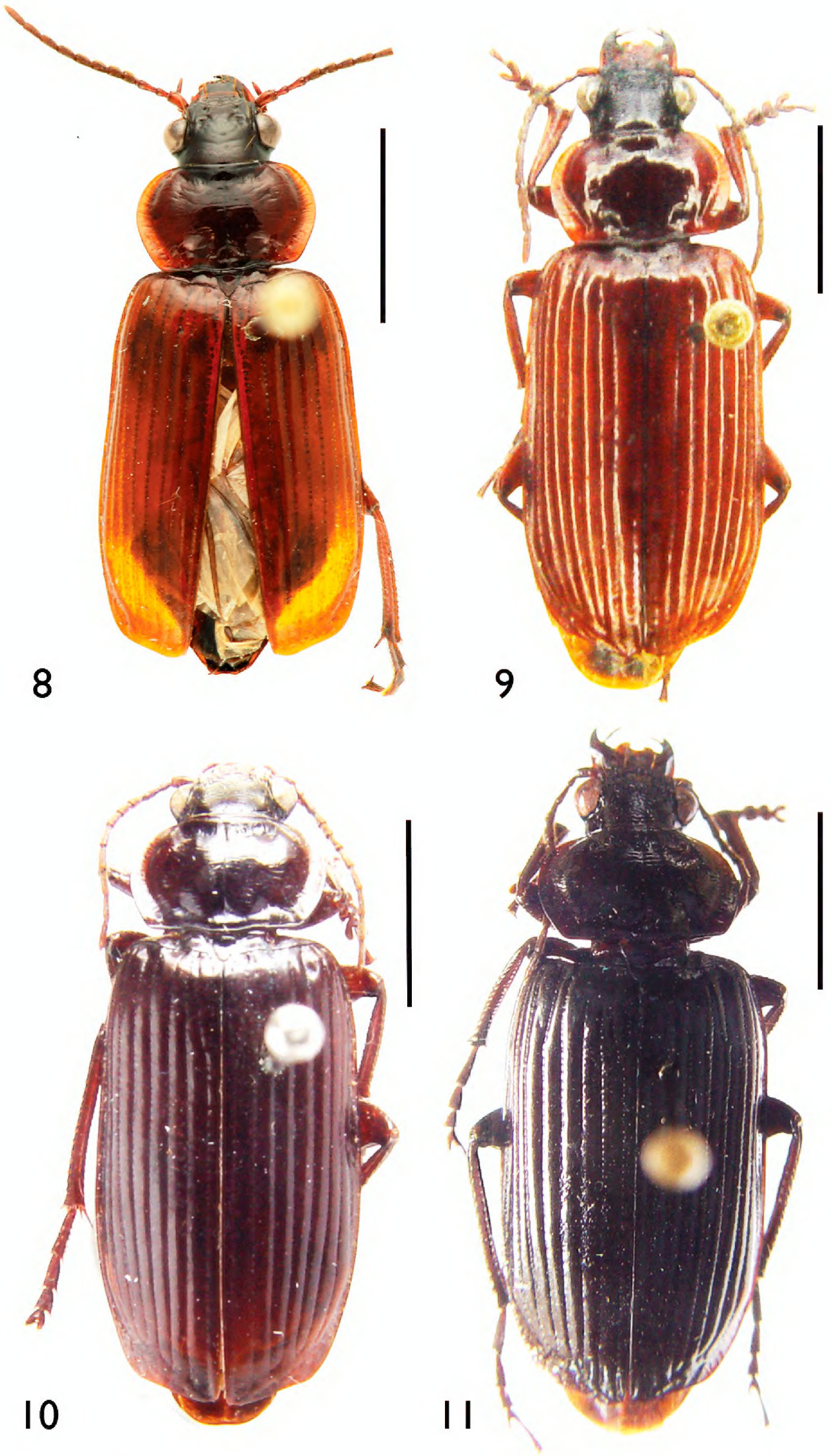
Figs 1–3b, 6, 16, 26–27

Holotype. Male, label "Coll. I.R.Sc.N.B./ Vietnam: Tam Dao NP, 25-28. VII, 2010, light trap, Leg. J. Constant & P. Limbourg; I.G. 31.668", in IRSNB.

Paratypes. 1 female, "Coll. I.R.Sc.N.B./ Vietnam: Cuc Phuong, Day coll. NG/ IG, 31.668, 11-18. VIII, 2010, Leg J. Constant & P. Limbourg", in IRSNB; 25 males & 14 females, "Coll. I.R.Sc.N.B./ Vietnam: Cuc Phuong N. P., 20.19'00" N, 105.36'30" E, 19-23. VII, 2011, night collecting, Leg J. Constant & P. Bresseel; I.G. 31.933", in IRSNB, MNHN and SCAU, respectively; 1 male, "N. Vietnam, Tamdao NP env. 1000 m, VI. 2012, ex coll. A. Popadic", in CIB; 2 females, in CIB and MNHN respectively.

Diagnosis. A medium-sized species, light dark brown in general, with rather flat and slender body which is smooth and glabrous, and asetose midcoxae and well bordered prosternal process.

Description. Length: 15.0–16.0 mm; width: 6.0–6.5 mm. Habitus as in Fig. 6.



Figures 8–11. Habitus **8** *O. aberlenci* sp. n. **9** *O. bellus* sp. n. **10** *O. freyi* **11** *O. duboisi*. Scale bar: 5.0 mm.

Body elongate, strongly shiny, smooth and glabrous. Head and disc of pronotum dark brown; elytra, lateral expanded margins of pronotum, mouthparts, antennae, legs and ventral surface reddish brown; whole body dark brown in several specimens. Surface impunctate, head moderately wrinkled on frons, smooth on vertex and pronotum. Microsculptural engraved meshes isodiametric on elytra, indistinct on head and pronotum.

Head longer than wide, HL/HW = 1.12–1.14, eyes small but prominent, frons and vertex moderately convex, frontal impressions large and deep; clypeus bisetose, basal portion even; labrum sex-setose, shallowly emarginate at front margin; palps slender, subcylindrical, the 3rd maxillary palpomere as long as the 4th which is glabrous, the 3rd palpomere with two short setae at apex; the 2nd labial palpomere slightly longer than the 3rd, bisetose in inner margin, with several additional setae at subapex and apex, the 3rd labial palpomere with a few setae at basal part; ligula small, bisetose at apex; mentum edentate; each of mentum and submentum bisetose (but an additional seta on the left of mentum in male), palpiger asetose. Antennae moderately long, extending over base of elytra; pubescent from basal 1/3 of the 4th antennomere, slightly expanded at pubescent portion of the 4th; the 3rd antennomere almost as long as the 4th.

Pronotum strongly transverse, PW/PL = 1.59–1.62, disc moderately convex, apical and basal margins well beaded, sides evenly expanded, widest at middle; base slightly wider than apex, bisinuate on base, slightly concave on apical margin; hind angle rounded off; lateral expanded margin well defined, evenly and indistinctly reflexed; both transversal impressions distinct, basal foveae small and deep.

Elytra elongate, and rather flat; EL/EW = 1.64–1.65; widest at about middle, sides parallel at middle, basal border complete, apex bisinuate, inner angle broad, with a small denticle (Fig. 16); striae moderately deep, intervals convex, odd and even intervals subequal in width in middle, the 3rd interval with three setiferous pores; the 7th interval simple.

Legs slender, fore tibiae expanded at apex, with outer angle strongly protrude, outer margin serrate; hind femora rather slender, with three posterior setae; middle coxae setose, hind coxae smooth and glabrous; middle tibiae quite straight, slightly expanded at apex; hind tibiae slightly expanded at apex, apical spurs long and sharp, the 3rd hind tarsomere slightly longer than the 4th which bilobed at apex; all tarsal claws weakly pectinate.

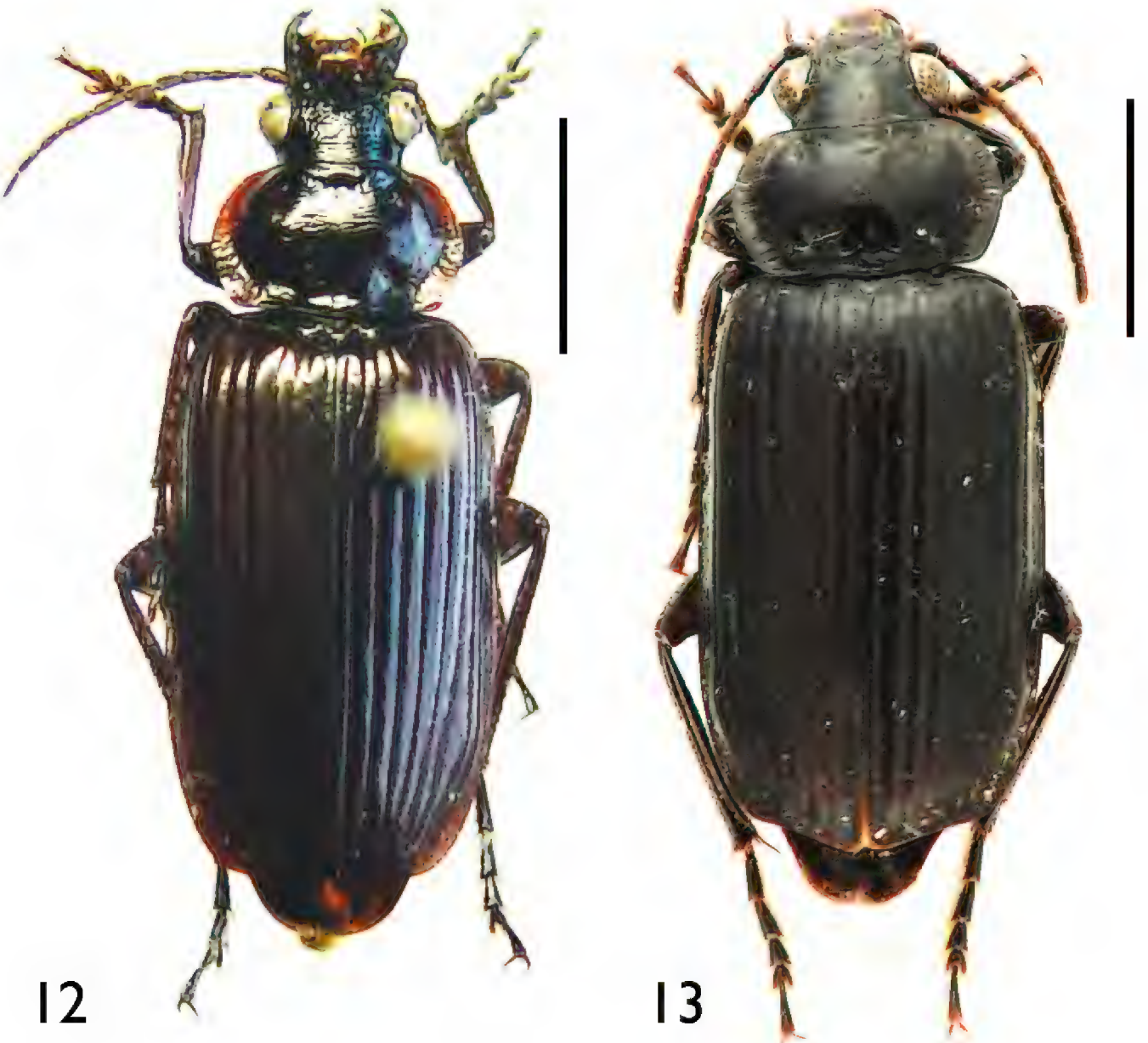
Prosternal process well bordered at apex. Abdominal ventrite VII of male complete; ventrite VII with two pairs of setae on either side of apical margin in both male and female.

Male genitalia: Stout, dorsal opening wide and long, base dilated, gently bent ventrally towards apex, which almost pointed in lateral view; in dorsal view, not contracted before apical lamella, which short and broad, as long as wide, surface granulated.

Remarks. It is allied to *O. politior* sp. n., but its clypeus bisetose (quadrisetose in *O. politior*), prosternal process well-bordered at apex (unbordered in *O. politior*), and the apical lamella of aedeagus shorter and broad at apex (longer and narrow in *O. politior*).

Etymology. In honor of P. Limbourg (Brussels), one of the holotype collectors.

Distribution. Northern Vietnam (Fig. 3b).



Figures 12–13. Habitus **12** *O. meghalayaensis* sp. n., holotype, male **13** *O. wrasei* sp. n., paratype, female. Scale bar: 5.0 mm.

***Orthogonius politior* sp. n.**
http://zoobank.org/32834F91-D7F4-4801-B957-936966D44D1F
Figs 3d, 7, 17, 28–30

Holotype. Male, "Laos-NE: Houa Phan Province, 20.13N/104.00E, Phou Pane Mt., 1350-1500 m, 1-16. VI. 2009, M. Brancucci leg.", "NHMB Basel, NMP Prague, Laos 2009 expedition: M. Brancucci, M. Geiser, Z. Kraus, D. Hauck, V. Kuban", in NHMB.

Diagnosis. A species similar to but larger than the above one, with also a rather flat and slender body, but having an unbordered prosternal process, a quadrisetose clypeus and setose midcoxae.

Description. Length: 19.0 mm; width: 6.8 mm. Habitus as in Fig. 7.

Body elongate, strongly shiny, smooth and glabrous. Head and disc of pronotum dark brown; elytra, lateral expanded margins of pronotum, mouthparts, antennae, legs and ventral surface reddish brown. Head and pronotum impunctate, elytral odd intervals with a few punctures; head moderately wrinkled; pronotum and elytra largely

smooth. Microsculptural engraved meshes isodiametric on elytra, rather transverse on pronotum, indistinct on head.

Head longer than wide, HL/HW = 1.09, eyes small but prominent, frons and vertex convex, frontal impressions large and deep; clypeus quadrisetose in male, basal portion even; labrum sex-setose, shallowly emarginate at apical margin; palps slender, subcylindrical, the 3rd maxillary palpomere as long as the 4th which glabrous, the 3rd maxillary palpomere with two short setae at apex; the 2nd labial palpomere slightly longer than the 3rd, bisetose on inner margin, with several additional setae at subapex and apex, the 3rd labial palpomere with a few setae at basal part; ligula small, bisetose at apex; mentum edentate; each of mentum and submentum bisetose (but a third seta on the left of mentum in the holotype), palpiger asetose. Antennae moderately long, extending over base of elytra; pubescent from basal 1/3 of the 4th antennomere, slightly expanded at pubescent portion of the 4th; the 3rd as long as the 4th.

Pronotum strongly transverse, PW/PL = 1.60, disc quite flat, apical and basal margins well beaded, sides evenly expanded, widest at middle; base wider than apex, bisinuate on base, slightly concave on apical margin; lateral expanded margin well defined, evenly and distinctly reflexed; both transversal impressions distinct, basal foveae small and deep.

Elytra elongate-ovate, EL/EW = 1.75; widest at about middle, sides parallel at middle, basal border complete, apex bisinuate, inner angle broad, but shortly denticulate (Fig. 17); striae moderately deep, intervals convex, subequal in width of odd and even intervals in middle, the 3rd interval with three setiferous pores; the 7th interval normal.

Legs rather slender, hind femora rather slender, with three posterior setae; fore tibiae expanded at apex, with outer angle strongly protrude, outer margin serrate; middle coxae setose, hind coxae smooth and glabrous; middle tibiae quite straight, slightly expanded at apex; hind tibiae slightly expanded at apex, apical spurs long and sharp, the 3rd hind tarsomere slightly longer than the 4th which bilobed at apex; all tarsal claws weakly pectinate.

Prosternal process unbordered at apex.

Male genitalia (Figs 28–30): Median lobe of aedeagus stout, dorsal opening wide and long, base dilated, gently bent ventrally towards apex, which almost pointed in profile; in dorsal view, median lobe distinctly contracted before apical lamella which short and thin, longer than wide.

Female: Unknown.

Remarks. It is very similar to *O. limbourgi*, with the differences mentioned above.

Etymology. Referred to its polished body.

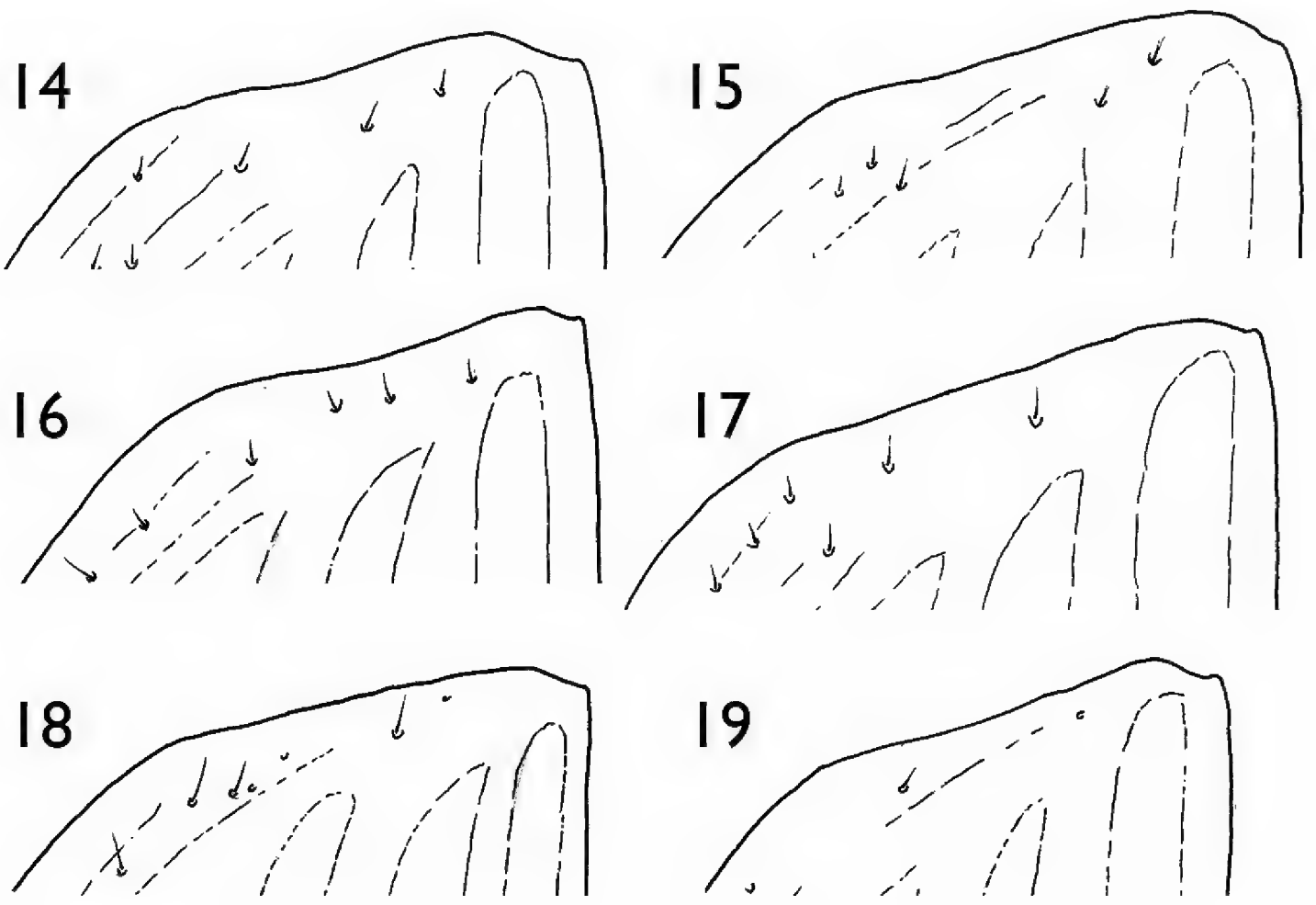
Distribution. Laos (Fig. 3d).

***Orthogonius aberlenci* sp. n.**

http://zoobank.org/15B791FA-FBB3-4DD9-8349-3BE664F7228D

Figs 3e, 8, 18, 31–32

Holotype. Male, label: "Laos: Province de Khammouane, rivière Hin Boun, Ban Nathan, campe de l'Agame, 17°59.773'N / 104°49.395'E, V. 2012, Piège Lumineux, IBCFL, Opération Canopée, H.-P. Aberlenc leg.", in MNHN.



Figures 14–23. Apex of right elytron **14** *O. jianfengling* **15** *O. himalayicus* **16** *O. limbourgi* sp. n. **17** *O. politior* sp. n. **18** *O. aberlenci* sp. n. **19** *O. bellus* sp. n. **20** *O. freyi* **21** *O. duboisi* **22** *O. meghalayaensis* sp. n. **23** *O. wrasei* sp. n.

Paratypes. 1 male & 3 females, in MNHN, SCAU and CIRAD (Montpellier).

Diagnosis. A medium-sized and stout species, with a shiny, smooth, and glabrous body which is brownish in general, and having an edentate mentum, a well bordered prosternal process and setose midcoxae.

Description. Length: 15.0–16.5 mm; width: 6.0–6.5 mm. Habitus as in Fig. 8.

Middle sized, stout, strongly shiny, smooth and glabrous. Head black; palps, pronotum, elytra, the 1st–3rd antennomeres, legs and ventral surface brownish; labrum,

clypeus, the 4th to 11th antennomeres dark brown. Head and pronotum impunctate, elytral odd intervals with a few fine and feeble punctures. Microsculptural engraved meshes isodiametric on elytra, indistinct on head and pronotum.

Head as long as wide, eyes moderate and prominent, frons and vertex convex, frontal impressions large and deep, extending posteriorly to the level of anterior supraorbital pores; clypeus bisetose, basal portion decorated by three short, longitudinal furrows which crossing base of clypeus and joining frontal impressions on either sides, and against frons medially; labrum sex-setose, moderately emarginate at apical margin; palps stout, subcylindrical, the 3rd maxillary palpomere slightly shorter than the 4th, glabrous on the 4th, the 3rd with three short setae at apex; the 2nd labial palpomere slightly longer than the 3rd, bisetose on inner margin, with several additional setae at subapex and apex, the 3rd labial palpomere with a few setae at basal part; ligula small, bisetose at apex; mentum edentate; each of mentum and submentum bisetose, setae subequal in length, palpiger asetose. Antennae moderately long, extending over base of elytra; pubescent from basal 1/3 of the 4th antennomere, where evidently expanded; the 3rd antennomere almost as long as the 4th, the 1st with a long seta at subapex.

Pronotum strongly transverse, PW/PL = 1.65, disc quite flat, apical and basal margins well beaded, sides evenly expanded, widest at middle; base wider than apex, bisinuate on base, slightly and widely concave on apical margin; lateral expanded margins well defined, narrow, evenly and distinctly reflexed; fore transversal impression faint, hind one distinct, basal foveae small but deep.

Elytra elongate, EL/EW = 1.70–1.75; widest at about middle, almost parallel-sided at middle, basal border complete, apex widely and nearly obliquely truncated on outer margin, then reversely truncated nearly the tip, inner angle nearly rectangular, not denticulate (Fig. 18); striae moderately deep, intervals convex, intervals subequal in width in middle, the 3rd interval with three setiferous pores; the 7th interval normal.

Legs moderately long, hind femora moderately expanded, with three posterior setae in male and four or five in female; fore tibiae expanded at apex, with outer angle shortly protruded, outer margin sub-serrate; middle coxae glabrous in holotype, but with one to three setae in median portion in other specimens, hind coxae smooth and glabrous; middle tibiae not modified in male, quite straight, serrate, gradually expanded towards apex; hind tibiae slightly expanded at apex, apical spurs very long and sharp, the 1st hind tarsomere distinctly longer than the 2nd, the 3rd as long as the 4th which deeply and symmetrically bilobed at apex; all tarsal claws weakly pectinate.

Prosternal process bordered at apex. Abdominal ventrite VII of male complete, with two pairs of setae on either side of apical margin in both male and female.

Male genitalia (Fig. 31–32): Short and stout, dorsal opening wide and long, somewhat expanded medially, gently bisinuate ventrally towards apex, which short and blunt in lateral view; apical lamella short and small, not parallel-sided, wider than long, apex broad.

Figures 24–30. Male genitalia (right lateral view and dorsal view for apical lamella) **24–25** *O. himalayicus* **26–27** *O. limbourgi* sp. n. **28–30** *O. politior* sp. n.

Remarks. It is probably allied to *O. limbourgi* sp. n. as they have similar structure of aedeagus. But it is easily separated from *O. limbourgi* and *O. politior* sp. n. by its short and more convex body, and short apical lamella of the aedeagus.

Etymology. The name of this new species is in honor of the collector, Henri-Pierre Aberlenc (CIRAD, Montpellier), an excellent entomologist and a friend of the second author.

Distribution. Laos (Fig. 3e).

Orthogonius bellus sp. n.

http://zoobank.org/AD1E656E-12F7-4F88-AD5C-ACF59BA56445

Figs 3c 9, 19, 36–37

Holotype. Male, "S. Vietnam, 40 km NW An Khe, Buon Luoi, 620-750 m", "14.10 N / 108.30 E, 28. III-12.IV. 1995, Pacholatko & Dembicky", "Mus. Wien."

Paratype. 1 male, ibid. in NHMV.

Diagnosis. A fairly large species, with a yellowish and slender body which is less depressed, but strongly shiny, smooth and glabrous, having a bordered prosternal process, an edentate mentum and asetose midcoxae.

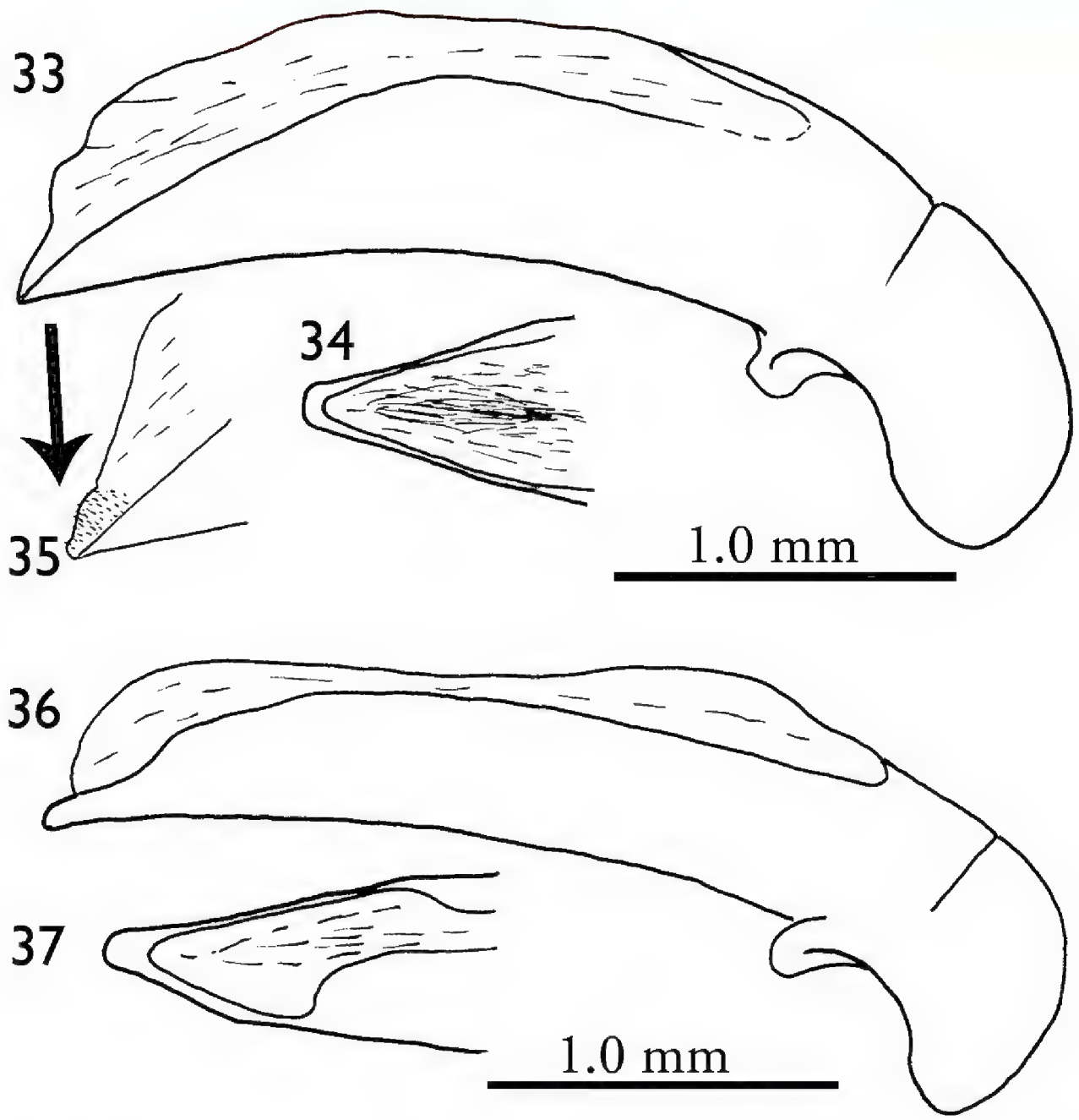
Description. Length: 18.5 mm; width: 7.0 mm. Habitus as in Fig. 9.

Body elongate, strongly shiny, smooth and glabrous. Yellowish to brown, except head which dark brown. Head and pronotum impunctate, elytral odd intervals with a few punctures. Microsculptural engraved meshes isodiametric on head and elytra, transverse on pronotum.

Head longer than wide, HL/HW = 1.12, eyes small but prominent, frons and vertex convex, frontal impressions deep and long, extending beyond the level of fore supraorbital setae; clypeus bisetose, basal portion of surface uneven; labrum sex-setose, faintly emarginate at apical margin; palps slender, subcylindrical, the 3rd maxillary palpomere as long as the 4th which glabrous; the 3rd maxillary palpomere with two short setae at apex; the 2nd labial palpomere slightly longer than the 3rd, bisetose on inner margin, with several additional setae at subapex and apex; the 3rd labial palpomere with a few setae at basal part; ligula small, bisetose at apex; mentum edentate; each of mentum and submentum bisetose, palpiger asetose. Antennae rather long, extending basal one third of elytra; pubescent from basal one third of the 4th antennomere, slightly expanded at pubescent portions; the 3rd antennomere almost as long as the 4th.

Pronotum strongly transverse, PW/PL = 1.64, disc moderately convex, apical and basal margins well beaded, sides evenly expanded, widest at middle; lateral expanded margin well defined and reflexed, surface uneven; both transversal impressions well marked, basal foveae small and deep.

Elytra elongate-ovate, EL/EW = 1.69; widest at about apical one third of elytra, sides parallel at middle, basal border complete, apex broadly sinuate, inner angle nearly rectangular (Fig. 19); striae deep, intervals distinctly convex, subequal in width with each other at middle, the 3rd interval with three setiferous pores.



Figures 31–37. Male genitalia (right lateral view and dorsal view for apical lamella) **31–32** *O. aberlenci* sp. n. **33–35** *O. bellus* sp. n. **36–37** *O. freyi*.

Legs rather slender, fore tibiae slightly expanded at apex, outer angle distinctly protruding and sharp, outer margin somewhat sub-serrate; middle and hind coxae smooth and glabrous; middle tibiae quite straight, slightly expanded at apex; hind tibiae hardly expanded at apex, apical spurs long and sharp; the 3rd hind tarsomere as long as the 4th which deeply bilobed at apex; claws weakly pectinate.

Prosternal process faintly bordered at apex.

Male genitalia (Figs 36–37): Stout, slightly sinuate at ventral side, dorsal opening wide, apex densely spinulate, apical lamella very short, broad, much wider than long.

Female: Unknown.

Remarks. Probably close to *O. limbourgi* sp. n., but its body less depressed, and hind 3rd tarsomere as long as 4th (versus in *O. limbourgi*).

Etymology. "*Bellus*", a Latin word meaning beautiful, refering to the charmof this species.

Distribution. Southern Vietnam (Fig. 3c).

Orthogonius freyi Tian & Deuve, 2006

Figs 3h, 10, 20, 36–37

Orthogonius freyi Tian & Deuve, 2006: 126.

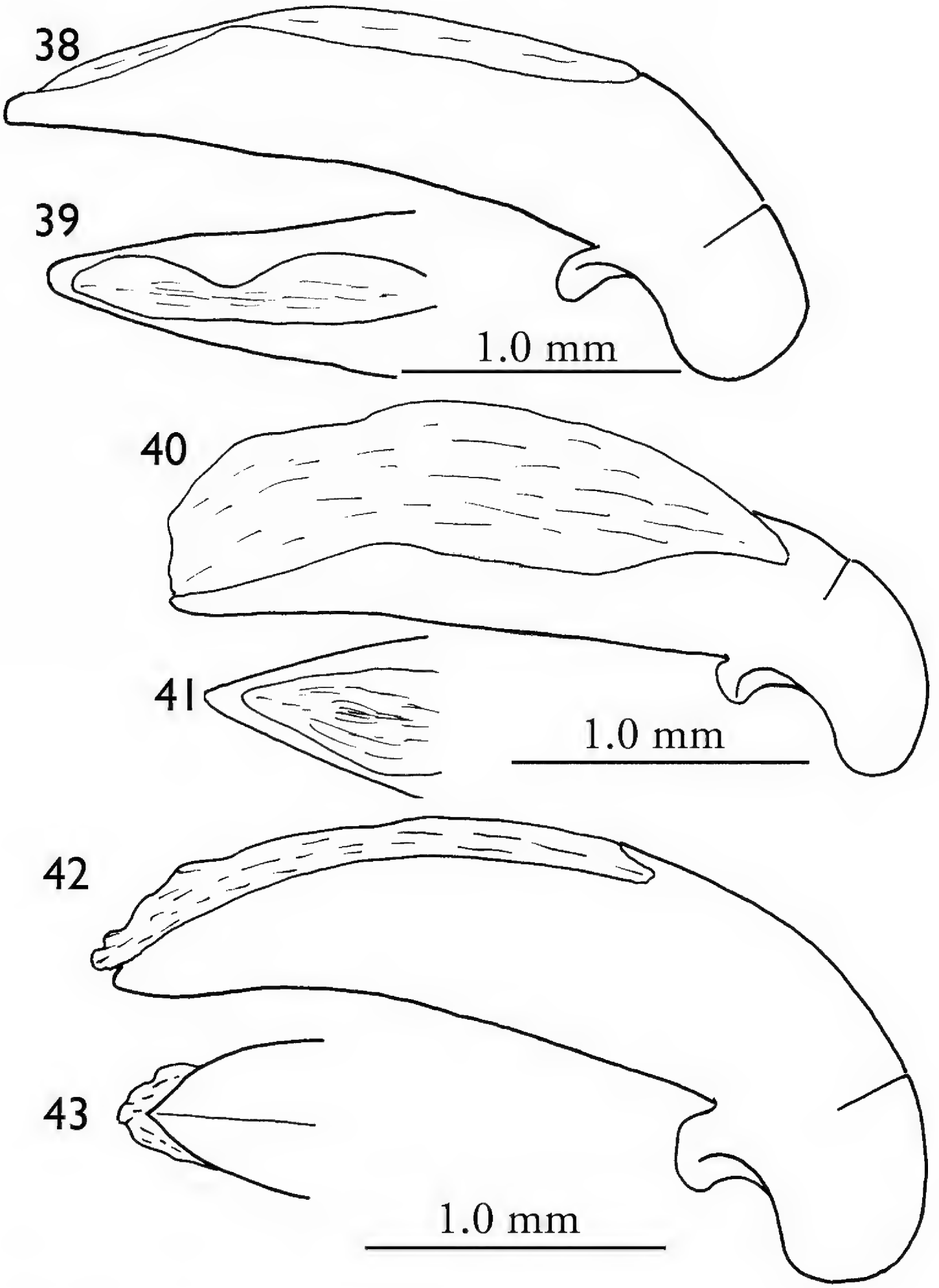
Length. 17.0 mm; width: 6.5 mm. Habitus as in Fig. 10.

Description. Dark brown to black, body rather slender and depressed, smooth and glabrous, microsculptural engraved meshes isodiametric on head, pronotum and elytra. Head longer than wide, HL/HW = 1.16, eyes rather small; labrum straight at frontal margin, sex-setose, clypeus bisetose; each of mentum and submentum each with a pair of setae. Pronotum strongly transverse, PW/PL = 1.60, widest a little before middle, lateral expanded margins well-marked, almost flat; elytra elongate-ovate, EL/EW = 1.73, convex, base well-bordered, parallel-sided, striae deep, intervals strongly convex, apex faintly sinuate, inner angle nearly rectangular, distinctly denticulate at tip (Fig. 20); the 3rd interval with two well-marked setiferous pores, median one wanted. Legs moderately long, the 4th hind tarsomere shorter than the 3rd, lobes of 4th tarsal emarginations half long as the tarsomere; tarsal claws weakly pectinate. Prosternal process well-bordered at apex; abdominal ventrite VII not emarginate at apical margin in male. Male genitalia (Figs 36–37) stout and short, apical lamella short, as wide as long at apex, tip almost truncated.

Remarks. Differs from other members of this species group by its labrum straight at front, and 3rd elytral interval with only two setiferous pores.

Material examined. The type series only: 1 male, holotype, "Birmah Momeit", "Doherty" "Frey Coll. 1905.100", "60827" and "*Orthogonius* sp." (By Andrewes); 1 female, a paratype, ibid, in NHML.

Distribution. Myanmar (Fig. 3h).



Figures 38–43. Male genitalia (right lateral view and dorsal view for apical lamella) **38–39** *O. duboisi* **40–41** *O. meghalayaensis* sp. n. **42–43** *O. wrasei* sp. n., right lateral view and ventral view.

Orthogonius duboisi Tian & Deuve, 2006

Figs 3f, 11, 21, 38–39

Orthogonius duboisi Tian & Deuve, 2006: 124

Length. 19.0 mm; width: 7.0 mm. Habitus as in Fig. 11.

Description. Dark brown, shiny, glabrous and smooth, but faint striate on head and pronotum; microsculptural engraved meshes isodiametric. Head slightly longer than wide, HL/HW = 1.10, eyes moderately sized, prominent, labrum slightly emarginate at frontal margin, clypeus bisetose; antennae backwardly exceeding elytral humeri. Pronotum transverse, PW/PL = 1.77, widest a little before middle, lateral expanded margin quite wide, slightly reflexed. Elytra elongate-ovate, rather flat, base well-bordered, parallel-sided medially, apex moderately sinuate, outer angle indistinct, inner angle large and obtuse, not denticulate (Fig. 21); striae deep, intervals slightly convex, subequal in width at middle; the 3rd interval with three setiferous pores. Hind tibial spurs quite short, but sharp; the 4th tarsomere shorter than the 3rd, deeply emarginate at apex, with lobes nearly half as long as joint. The prosternal process bordered at apex. Male genitalia (Figs 38–39): Short and stout, apex broad, the apical lamella very short and broad.

Female: Unknown.

Remarks. It is similar to *O. freyi*, but its inner apical angle of elytra is obtuse and not denticulate at tip (versus in *O. freyi*), and the male aedeagus is stouter.

Material examined. 1 male, the holotype, "CHINE-Yunnan, Tongbiguan, 24°36'N, 97°35'E, 1180 m", "14. VI. 2001, Deuve, Mantilleri, Rougerie & Tian leg.", in SCAU.

Distribution. China (Yunnan).

Orthogonius meghalayaensis sp. n.

http://zoobank.org/7151FBFF-2EDC-44EA-AF90-C54217557D6A

Figs 3j, 12, 22, 40–41

Holotype. Male, "NE India: Meghalaya, W. Garo Hills, Nokrek National Park, ca 1000 m", "25.29.06 N / 90.19.05 E, 9-17. V. 1996, leg. Jendek & Sausa", "Mus. Wien."

Paratype. 1 female, ibid, in NHMV.

Diagnosis. A dark brown or black species, having a elongate body, a deeply emarginate labrum, an edentate mentum, a well bordered prosternal process, setose mid-coxae and a 6-setose ventrite VII.

Description. Length: 18.5–19.0 mm; width: 6.5 mm. Habitus as in Fig. 12.

Body elongate, shiny. Head and disc of pronotum black to dark brown; elytra, lateral expanded margins of pronotum, mouthparts, antennae, legs and ventral surface reddish dark brown. Female darker than male. Head and pronotum impunctate, elytral odd intervals with a few punctures; head densely and moderately wrinkled and intricate; pronotum transversally striate, elytra smooth. Microsculptural engraved meshes isodiametric on elytra, rather transverse on head and pronotum.

Head longer than wide, HL/HW = 1.04, eyes small but prominent, frons and vertex convex, frontal impressions deep; clypeus bisetose, basal portion of surface uneven; labrum sex-setose, deeply emarginate at apical margin; palps slender, subcylindrical, the 3rd maxillary palpomere as long as the 4th which glabrous, the 3rd maxillary palpomere with two short setae at apex; the 2nd labial palpomere slightly longer than the 3rd, bisetose on inner margin, with several additional setae at subapex and apex, the 3rd labial palpomere with a few setae at basal part; ligula small, bisetose at apex; mentum with a median tooth, but not well-defined; each of mentum and submentum bisetose, palpiger asetose. Antennae moderately long, extending over base of elytra; pubescent from basal one third of the 4th antennomere, slightly expanded at pubescent portion; the 3rd antennomere almost as long as the 4th.

Pronotum strongly transverse, PW/PL = 1.60, disc moderately convex, apical and basal margins well beaded, sides evenly expanded, widest at middle; lateral expanded margins well defined, flat and not reflexed, surface uneven; both transversal impressions distinct, basal foveae small and deep.

Elytra elongate ovate, EL/EW = 1.67, widest at about middle, sides parallel at middle, basal border complete, apex broadly sinuate, inner angle broadly acute (Fig. 22); striae shallow, intervals rather flat or slightly convex, subequal in width with each other in middle, the 3rd interval with three setiferous pores; the 7th interval normal.

Legs rather slender, fore tibiae slightly expanded at apex, outer angle distinctly protrude, outer margin somewhat sub-serrate; middle and hind coxae smooth and glabrous; middle tibiae quite straight, slightly expanded at apex; hind tibiae hardly expanded at apex, apical spurs long and sharp, the 3rd hind tarsomere much longer than the 4th which deeply emarginate at apex (lobes half as long as the joint); claws weakly pectinate.

Prosternal process unbordered at apex. Ventrite VII with three pairs of setae on either side of apical margin in both sexes.

Male genitalia (Figs 40–41): Short and stout, nearly straight ventrally, dorsal opening very large, almost extending to base; apical lamella short, contracted towards apex, slightly wider than long.

Remarks. Separable from other congeners by sex-setose on ventrite VII, deeply emarginate labrum at apical margin and dentate mentum.

Etymology. Referred to the type locality.

Distribution. India.

***Orthogonius wrasei* sp. n.**

http://zoobank.org/5A827310-DE68-48D9-B997-B7161BCBA7DC

Figs 3g, 13, 23, 42–43

Holotype. Male, "Myanmar (Magway State), nr. Kyeto Pass between Padaukaing-Ngabyin, 850 m, 21.88911 N / 094.41589 E, (secondary forest, lux), 30. VI. 2005, leg. M. Hoffmann & T. Ihle", "Coll. Wrase BERLIN", in CDW.

Paratypes. 5 females, ibid. in CDW, MNHN and SCAU.

Diagnosis. A black (including lateral expanded pronotal margins) and stout species, having nearly rectangular inner apical angles of elytra, an edentate mentum, a well bordered prosernal process and setose midcoxae.

Description. Length: 18.5–19.0 mm; width: 6.5 mm. Habitus as in Fig. 13.

Body elongate, smooth and shiny. Body black, except palps dark brown. Head and pronotum impunctate, elytral odd intervals with small and sparse punctures; head and pronotum obscurely striate. Microsculptural engraved meshes isodiametric on head and elytra, transverse on pronotum.

Head longer than wide, HL/HW = 1.11–1.13, eyes rather small but prominent, frons and vertex convex, frontal impressions deep, extending beyond level of the fore supraorbital setae; clypeus bisetose, surface almost even; labrum sex-setose, slightly emarginate at apical margin; palps slender, subcylindrical, the 3rd maxillary palpomere as long as the 4th which glabrous, the 3rd with two short setae at apex; the 2nd labial palpomere slightly longer than the 3rd, bisetose on inner margin, with several additional setae, the 3rd labial palpomere with a few setae at basal part; ligula small, bisetose at apex; mentum without distinct tooth; each of mentum and submentum bisetose, palpiger asetose. Antennae moderately long, extending over base of elytra; pubescent from basal two fifth of the 4th antennomere, slightly expanded at pubescent portion; the 3rd almost as long as the 4th.

Pronotum strongly transverse, PW/PL = 1.76–1.77, disc moderately convex, apical and basal margins well beaded, sides strongly expanded, widest at middle; lateral expanded margins well defined, flat and not reflexed, surface somewhat striate; fore and hind angles broadly rounded; both transversal impressions well marked, basal foveae small and deep.

Elytra elongate ovate, EL/EW = 1.66–1.68, widest at about middle, parallel-sided at middle, basal border complete, apex broadly and obliquely truncated, inner angle nearly rectangular (Fig. 23); striae deep, intervals strongly convex, subequal in width at middle, the 3rd interval with three setiferous pores.

Legs rather slender, fore tibiae slightly expanded at apex, apical margin sinuate, outer angle distinctly protrude, outer margin sub-serrate; middle coxae setose, hind ones smooth and glabrous; middle tibiae quite straight, slightly expanded at apex; hind tibiae slightly expanded at apex, apical spurs long and sharp, the 3rd hind tarsomere longer than the 4th which deeply emarginate at apex (lobes one third as long as the segment); claws strongly pectinate.

Prosternal process well bordered at apex. Ventrite VII quadrisetose in both male and female;

Male genitalia (Figs 42–43): Stout and robust, shallowly sinuate ventrally, dorsal opening very wide, gently and gradually narrowed towards apex, which blunt in lateral view; apical lamella very short, and very sharp in ventral view.

Remarks. Recognized by its black body and nearly rectangular inner apical angles of elytra.

Etymology. This new species is named in honor of David W. Wrase (Berlin).

Distribution. Myanmar.

Acknowledgements

We are very grateful to A. Taghavian (MNHN, Paris), the late M. Brancucci (NHMB, Basel), C. Taylor (NHML, London), A. Drumont (IRSNB, Brussels), I. Brunk (Dresden) and H.-P. Aberlenc (Montpellier) for providing material for our study, to E. Kirschenhofer (Perchtoldsdorf) for arranging the loans from collections of CDW (Berlin) and NHMV (Vienna). We thank also B. Gueorguiev (National Museum of Natural History, Sofia) and H. L. Shi (Beijing Forestry University, Beijing) for their suggestions and comments which are helpful to improve the manuscript. In particular, the first author would express his sincere appreciations to MNHN, Paris for its long-term financial and logistic support to his study. This work is also partly sponsored by the National Natural Science Foundation of China to the first author (Grant no. 41271062).

References

Myers N, Mittermier RA, Mittermier CG, Da Fonseca GAB, Kent J (2000) Biodiversity hotspots for conservation priorities. Nature 403: 853–858. doi: 10.1038/35002501

Tian MY, Deuve T (2000) Contributions to the knowledge of the genus *Orthogonius* Macleay of China (Coleoptera, Carabidae, Orthogoniini). Nouvelle Revue d'Entomologie 17: 293–304.

Tian MY, Deuve T (2005) Species of the genus *Orthogonius* Macleay (Coleoptera, Caraboidea) from Bhutan and Sikkim. Acta Zootaxonomica Sinica 30(3): 601–605.

Tian MY, Deuve T (2006) Contribution to the knowledge of the tribe Orthogoniini of the Oriental Region. I. (Coleoptera: Caraboidea). I, II. Coléoptères 12(8/9): 69–154.

Tian MY, Deuve T (2010) A provisional species checklist of the Oriental Orthogoninae (Coleoptera: Caraboidea). Entomotaxonomia 32 (Suppl.): 137–148.

Tian MY, Deuve T (2013) Definition and review of the *lancangjiang* species group of the termitophilous genus *Orthogonius* MacLeay, 1825 (Coleoptera, Carabidae, Orthogoniini). ZooKeys 349: 81–100. doi: 10.3897/zookeys.349.6164

Tian MY, Deuve T (2016) A review of the *baconii* species group of the termitophilous genus *Orthogonius* MacLeay (Coleoptera: Carabidae: Orthogoniini). Zootaxa 4093(1): 118–126. doi: 10.11646/zootaxa.4093.1.7

Tian MY, Deuve T, Felix R (2012) *Orthogonius* species and diversity in Thailand (Coleoptera, Caraboidea, Orthogoniini), a result from the TIGER project. ZooKeys 164: 51–90. doi: 10.3897/zookeys.164.1992